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Patent Abstracts of Japan

X 1-3,7, 19-23

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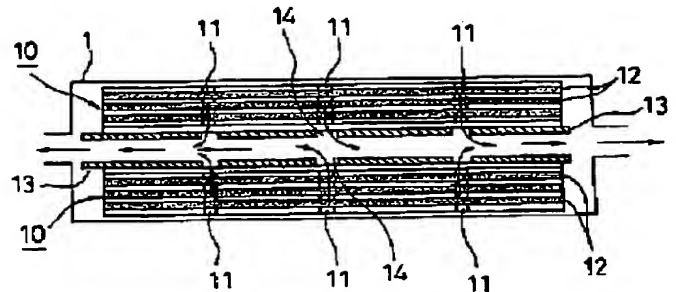
APPLICATION DATE : 29-11-96
APPLICATION NUMBER : 08319957

APPLICANT : NISSAN MOTOR CO LTD;

INVENTOR : HORIE HIDEAKI;

INT.CL. : H01M 2/12 H01M 10/04

TITLE : SECONDARY BATTERY



ABSTRACT : PROBLEM TO BE SOLVED: To sufficiently discharge generated gas outside, and restrain the deterioration of performance of a battery by forming a gas passage by respectively boring plural small holes in a hollow core body and current collecting foil of a positive electrode and a negative electrode.

SOLUTION: In a secondary battery where an electrode structure body wound in a spiral shape round a hollow winding core 13 is housed inside a battery case 1 where terminals are respectively arranged on both ends, gas blow-off plural small holes 11 are bored in the direction orthogonal to the lengthwise direction in current collecting body foil of a positive electrode and a negative electrode to constitute the electrode structure body 10, and plural core body side small holes 14 are also bored in the winding core 13, and a gas passage is formed of the current collecting body foil side small holes 11, a gas permeable separator 12, the core body side small holes 14 and a hollow part of the winding core 13. When gas is generated at charging and discharging the secondary battery, the gas is blow off outside by a cleavage valve arranged in a central part of a terminal and a terminal by passing through this gas passage. Therefore, the deterioration of performance of the secondary battery caused by insufficiency of letting-out of gas can be prevented.

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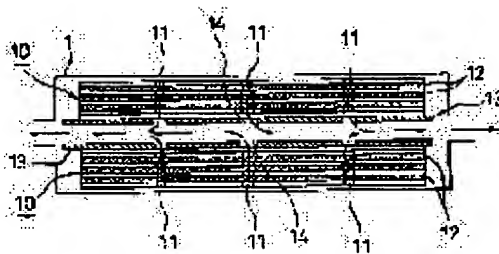
(72)Inventor : HORIE HIDEAKI

(54) SECONDARY BATTERY

(57)Abstract:

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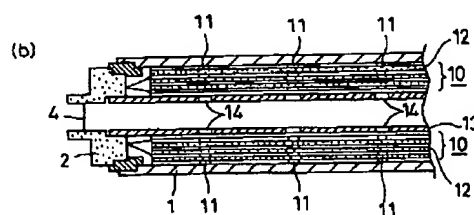
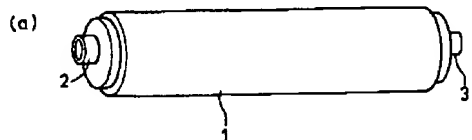
(74)代理人 弁理士 三好 秀和 (外8名)

(54)【発明の名称】 二次電池

(57)【要約】

【課題】 本発明は、電極構造体が密に構成されていても、発生ガスを十分に外部に排出することを目的とする。

【解決手段】 中空の芯体13に複数の芯体側小孔14を穿設し、この芯体13に巻き上げた正極側集電体箔及び負極側集電体箔にそれぞれ複数の集電体箔側小孔11を穿設し、集電体箔側小孔11及び芯体側小孔14でガス流路を形成したことを特徴とする。



【特許請求の範囲】

【請求項1】 正極活物質を設けた正極側集電体箔と負極活物質を設けた負極側集電体箔とをガス透過性のセパレータを間に挟んで中空の芯体に巻き上げて電極構造体を構成し、前記正極側集電体箔及び負極側集電体箔にそれぞれ複数の集電体箔側小孔を穿設し、前記芯体に複数の芯体側小孔を穿設し、前記集電体箔側小孔及び前記芯体側小孔で前記電極構造体内に発生したガスを排出するガス流路を形成してなることを特徴とする二次電池。

【請求項2】 前記正極活物質を含む前記正極側集電体箔の全面及び前記負極活物質を含む前記負極側集電体箔の全面にそれぞれ絶縁性を有する無機質微粒子を担持させてなることを特徴とする請求項1記載の二次電池。

【請求項3】 前記電極構造体を収納する電池ケースの内面に、前記集電体箔側小孔が臨む溝状ガス流路を形成してなることを特徴とする請求項1記載の二次電池。

【請求項4】 芯体上に巻き上げた正極側集電体箔及び負極側集電体箔を含んで構成された電極構造体に、当該電極構造体内に発生したガスを排出するガス流路を形成してなることを特徴とする二次電池。

【発明の詳細な説明】

【0001】

【発明の属する技術分野】本発明は、二次電池に関する。

【0002】

【従来の技術】従来の二次電池としては、例えば図8に示すようなものがある。同図において、31は電池ケース、32は電極であり、電池ケース31には圧力弁33が設置されている。充放電中に電池内部に発生したガスが規定の圧力を超えると、圧力弁33が作用して、ガスが外部に放出されるようになっている。

【0003】

【発明が解決しようとする課題】しかしながら、このような従来の二次電池にあっては、電池性能の向上等のために電極が密に構成された場合、電極はガスが通りにくい構造となっていたため、電池内部にガスが発生したとき、ガス抜けが不十分となつてかえって電池性能の低下を引き起こすおそれがあるという問題点があった。

【0004】本発明は、このような従来の問題点に着目してなされたもので、電極構造体が密に構成されていても、発生ガスを十分に外部に排出することができ、ガス抜けの不十分による電池性能の低下を防止することができる二次電池を提供することを目的とする。

【0005】

【課題を解決するための手段】上記課題を解決するために、請求項1記載の発明は、正極活物質を設けた正極側集電体箔と負極活物質を設けた負極側集電体箔とをガス透過性のセパレータを間に挟んで中空の芯体に巻き上げて電極構造体を構成し、前記正極側集電体箔及び負極側集電体箔にそれぞれ複数の集電体箔側小孔を穿設し、前

記芯体に複数の芯体側小孔を穿設し、前記集電体箔側小孔及び前記芯体側小孔で前記電極構造体内に発生したガスを排出するガス流路を形成してなることを要旨とする。この構成により、充放電中に電極構造体内でガスが発生した場合、正極側集電体箔、セパレータ及び負極側集電体箔の積層体の巻き上げにより電極構造体が密に構成されていても、発生ガスはガス流路を通して外部に排出される。

【0006】請求項2記載の発明は、上記請求項1記載の二次電池において、前記正極活物質を含む前記正極側集電体箔の全面及び前記負極活物質を含む前記負極側集電体箔の全面にそれぞれ絶縁性を有する無機質微粒子を担持させてなることを要旨とする。この構成により、ガス排出時等においてセパレータに破損が生じた場合でも、正極側集電体箔と負極側集電体箔とが電氣的に接触することが防止されて、異常な発熱の生じることがない。

【0007】請求項3記載の発明は、上記請求項1記載の二次電池において、前記電極構造体を収納する電池ケースの内面に、前記集電体箔側小孔が臨む溝状ガス流路を形成してなることを要旨とする。この構成により、ガス流路が増えることで、発生ガスの排出が一層良好になる。

【0008】請求項4記載の発明は、芯体上に巻き上げた正極側集電体箔及び負極側集電体箔を含んで構成された電極構造体に、当該電極構造体内に発生したガスを排出するガス流路を形成してなることを要旨とする。この構成により、電極構造体が密に構成されていても、ガス流路は、例えば、正極側集電体箔及び負極側集電体箔のそれぞれに穿設した複数の小孔、芯体に穿設した複数の小孔及び芯体の中空部等で実現することができ、上記請求項1記載の発明の作用と略同様の作用が得られる。

【0009】

【発明の効果】請求項1記載の発明によれば、正極活物質を設けた正極側集電体箔と負極活物質を設けた負極側集電体箔とをガス透過性のセパレータを間に挟んで中空の芯体に巻き上げて電極構造体を構成し、前記正極側集電体箔及び負極側集電体箔にそれぞれ複数の集電体箔側小孔を穿設し、前記芯体に複数の芯体側小孔を穿設し、前記集電体箔側小孔及び前記芯体側小孔で前記電極構造体内に発生したガスを排出するガス流路を形成したため、電極構造体が密に構成されていても、発生ガスがガス流路を通して外部に排出されることで、ガス抜けの不十分による電池性能の低下を防止することができる。

【0010】請求項2記載の発明によれば、前記正極活物質を含む前記正極側集電体箔の全面及び前記負極活物質を含む前記負極側集電体箔の全面にそれぞれ絶縁性を有する無機質微粒子を担持させたため、ガス排出時等にセパレータに破損が生じた場合でも、正極側集電体箔と負極側集電体箔との電氣的接触による異常発熱が抑えら

れて電池劣化を防止することができる。

【0011】請求項3記載の発明によれば、前記電極構造体を収納する電池ケースの内面に、前記集電体箔側小孔が臨む溝状ガス流路を形成したため、発生ガスの排出が一層良好になって、ガス抜けの不十分による電池性能の低下を一層確実に防止することができる。

【0012】請求項4記載の発明によれば、芯体上に巻き上げた正極側集電体箔及び負極側集電体箔を含んで構成された電極構造体に、当該電極構造体内に発生したガスを排出するガス流路を形成したため、電極構造体が密に構成されていても、ガス流路は、例えば、正極側集電体箔及び負極側集電体箔のそれぞれに穿設した複数の小孔、芯体に穿設した複数の小孔及び芯体の中空部等で実現することができ、上記請求項1記載の発明の効果と略同様の効果がある。

【0013】

【発明の実施の形態】以下、本発明の実施の形態を図面に基づいて説明する。

【0014】図1乃至図5は、本発明の第1の実施の形態を示す図である。まず、図1乃至図4を用いて、二次電池の構成を説明する。図1は、全体構成を示している。同図(a)は外観斜視図、同図(b)は内部構成を示す縦断面図、同図(c)は断面斜視図である。これらの図において、1は電池ケースであり、その両端に端子2、3が設けられ、各端子2、3の中央部には電池内部で発生したガスを放出するための開裂弁4が設けられている。電池ケース1内には、後述するように、正極活物質の塗布された集電体箔と、負極活物質の塗布された集電体箔とが電解液を含有するセパレータ12を間に挟んで、中空の巻取芯(芯体)13上にスパイラルに巻き上げられた電極構造体10が収納されている。電極構造体10の正極は陽極端子に接続され、負極は陰極端子に接続されている。そして、電極構造体10を構成する集電体箔には、電極構造体10の長手方向と直交する方向にガス放出孔となる複数個の小孔11が開けられ、中空の巻取芯13にも同様にガス放出孔となる複数個の小孔14が開けられている。

【0015】図2は、集電体箔7の構成(同図(a))と、巻取芯13の構成(同図(b))を示している。集電体箔7には、巻き上げ方向と同方向に、活物質8の塗布領域と小孔11の穿設領域とが位置を分けて交互に複数列形成されている。また、巻取芯13には、集電体箔7側の小孔11の穿設領域に対応した各位置においてそれぞれ周方向に複数個の小孔14が開けられている。巻取芯13側の各小孔14は、集電体箔7側の各小孔11よりもやや大きい。

【0016】図3は、正極5となる集電体箔7a、負極6となる集電体箔7b及びセパレータ12の積層構造を示している。図3(b)は、同図(a)のA-A線断面を拡大して模式的に示す図である。正極5及び負極6の

各集電体箔7a、7bには、正・負の活物質8a、8bの塗布領域を含む全面に、シリカ、SiC等の絶縁性を有する無機質微粒子9がバインダーで担持されている。セパレータ12はフィルタ機能を持ちガス透過性を有して電解液が含有されている。

【0017】図4及び図5は、端子2、3部の構成例をそれぞれ示している。図4の端子2aでは、圧着端子15との接触面にネジ穴16が設けられ、圧着端子15がネジ止めにより取り付けられている。図5の端子2bでは、中軸部にネジ山18が切られ、圧着端子15がナット19の締め込みにより取り付けられている。そして、両端子2a、2b共に圧着端子15との接触面は広面積にとつてある。

【0018】次に、図6を用いて、上述のように構成された二次電池の作用を説明する。集電体箔7に開けられた各小孔11、ガス透過性のセパレータ12、巻取芯13に開けられた各小孔14及び巻取芯13の中空部でガス流路が形成される。二次電池の充放電中に電極構造体10内部でガスが発生した場合、発生ガスは上記のガス流路を通り、端子2、3中央部の開裂弁4より外部に放出される。したがって、ガス抜けの不十分により電池性能の低下等の現象が防止される。そして、ガス放出時等においてセパレータ12が破れることがあっても、集電体箔7a、7bの全面に絶縁性を有する無機質微粒子9が担持されていることで、正・負極5、6の集電体箔7a、7b同士は直接接触せず、異常な発熱が起きることはない。

【0019】図7には、本発明の第2の実施の形態を示す。本実施の形態は、電池ケースの内表面に集電体箔7側の小孔11が臨む溝状のガス流路を設けたものである。同図(a)は、電池ケース1aの内表面に集電体箔7の複数の小孔11に沿ってガス流路21を設けたものである。同図(b)は、電池ケース1bの内表面にガス流路となる細かい溝22を設けたものであり、電極構造体10を電池ケース1bの全内面で保持しつつ、ガス抜けを確保するようにしたものである。溝22の断面形状は適宜の形状でよい。同図(c)は、電池ケース1cの内表面にはガス流路21を設け、外表面には放熱用フィン23を設けたものである。何れの電池ケース1a、1b、1cを適用しても、電池全体のガス流路が増えることで、電池からのガス抜けが一層良好となる。

【図面の簡単な説明】

【図1】本発明に係る二次電池の第1の実施の形態を示す外観斜視図及び縦断面図である。

【図2】上記第1の実施の形態における集電体箔及び巻取芯の構成を示す図である。

【図3】上記第1の実施の形態における正極側集電体箔、セパレータ及び負極側集電体箔の積層構造を示す図である。

【図4】上記第1の実施の形態における端子部の構成例

を示す図である。

【図5】上記第1の実施の形態における端子部の他の構成例を示す図である。

【図6】上記第1の実施の形態の作用を説明するための図である。

【図7】本発明の第2の実施の形態における電池ケース部の構成を示す斜視図である。

【図8】従来の二次電池の内部構成を示す図である。

【符号の説明】

1, 1a, 1b, 1c 電池ケース

4 開裂弁

7 集電体箔

7a 正極側集電体箔

7b 負極側集電体箔

8 活物質

8a 正極活物質

8b 負極活物質

9 無機質微粒子

10 電極構造体

11 集電体箔側小孔

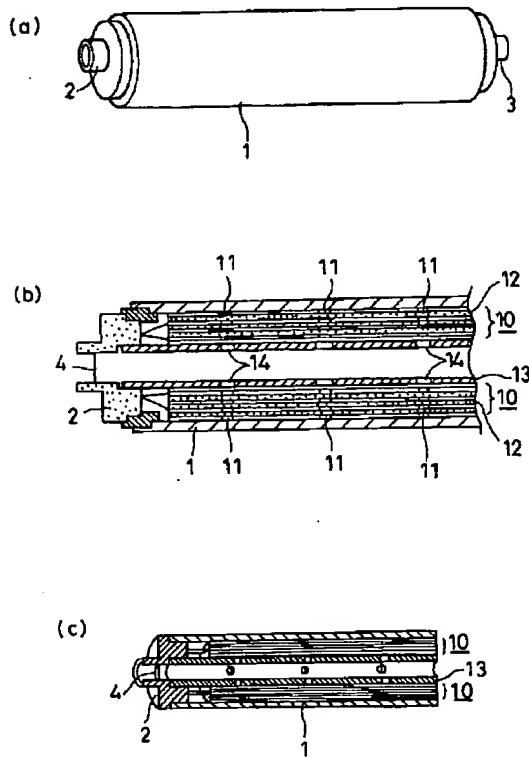
12 セパレータ

10 13 巻取芯(芯体)

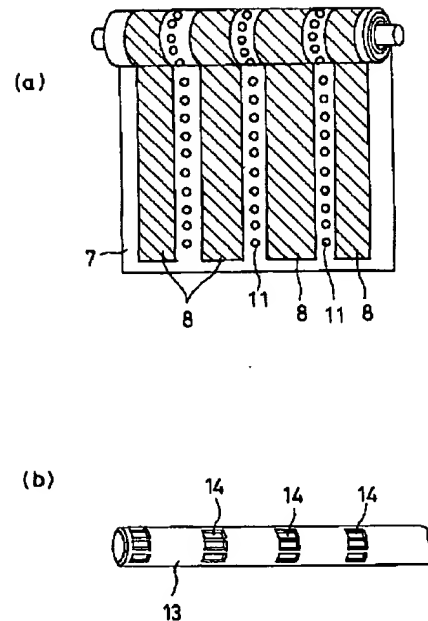
14 芯体側小孔

21 溝状ガス流路

【図1】



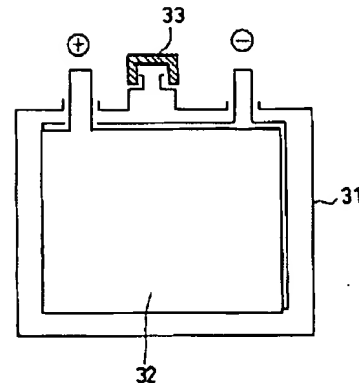
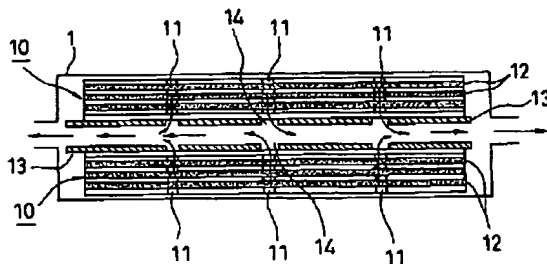
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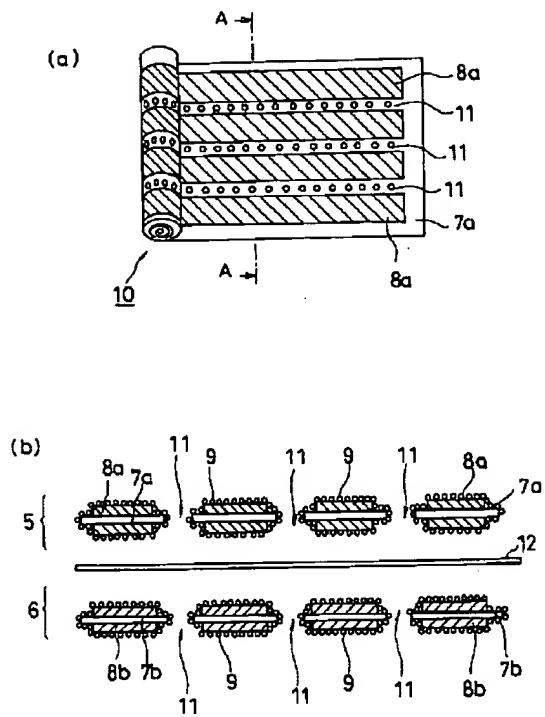
【図8】

Pror Art

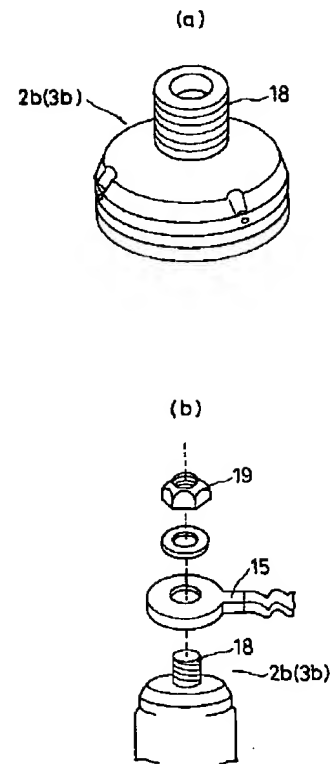
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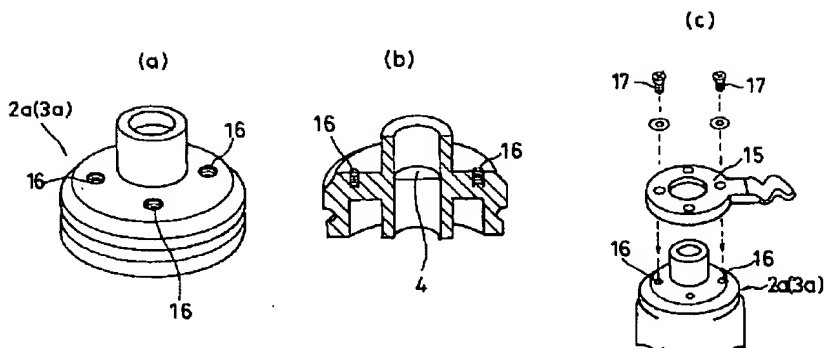
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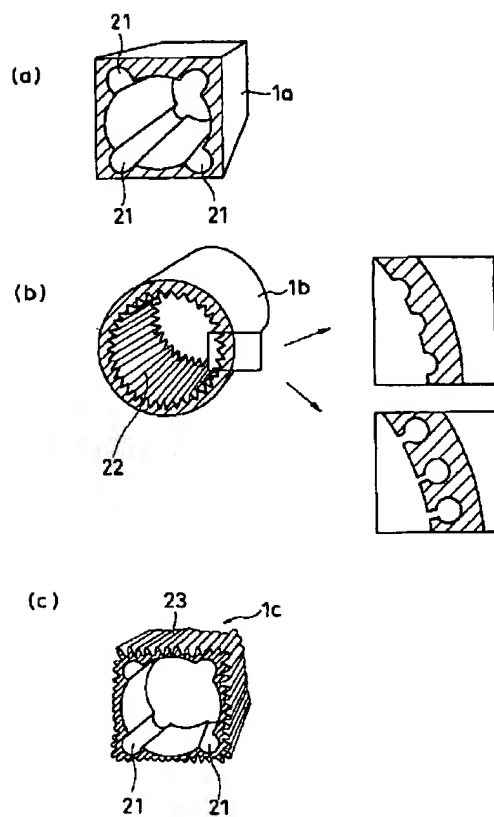
【図5】



【図4】



【図7】



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CLAIMS

[Claim(s)]

[Claim 1] On both sides of the separator of gas permeability, wind up in between the positive-electrode side charge collector foil which prepared the positive active material, and the negative-electrode side charge collector foil which prepared the negative-electrode active material to an axis in the air, and the electrode structure is constituted. The rechargeable battery which drills two or more charge collector foil side stomata in the aforementioned positive-electrode side charge collector foil and a negative-electrode side charge collector foil, respectively, drills two or more axis side stomata in the aforementioned axis, forms the gas passageway which discharges the gas which occurred in the aforementioned electrode structure in the aforementioned charge collector foil side stoma and the aforementioned axis side stoma, and is characterized by the bird clapper.

[Claim 2] The rechargeable battery according to claim 1 which is made to support the minerals particle which has insulation all over the aforementioned negative-electrode side charge collector foil containing the whole surface and the aforementioned negative-electrode active material containing the aforementioned positive active material of the aforementioned positive-electrode side charge collector foil, respectively, and is characterized by the bird clapper.

[Claim 3] The rechargeable battery according to claim 1 which forms the slot-like gas passageway which the aforementioned charge collector foil side stoma faces the inside of the cell case which contains the aforementioned electrode structure, and is characterized by the bird clapper.

[Claim 4] The rechargeable battery which forms the gas passageway which discharges the gas which occurred in the electrode structure concerned in the electrode structure constituted including the positive-electrode side charge collector foil wound up on the axis, and the negative-electrode side charge collector foil, and is characterized by the bird clapper.

[Translation done.]

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DETAILED DESCRIPTION

[Detailed Description of the Invention]

[0001]

[The technical field to which invention belongs] this invention relates to a rechargeable battery.

[0002]

[Description of the Prior Art] As a conventional rechargeable battery, there is a thing as shown, for example in drawing 8. In this drawing, 31 is a cell case, 32 is an electrode, and the pressure valve 33 is installed in the cell case 31. If the gas which occurred inside the cell in charge and discharge exceeds a regular pressure, the pressure valve 33 will act and gas will be emitted outside.

[0003]

[Problem(s) to be Solved by the Invention] However, if it was in such a conventional rechargeable battery, when an electrode was densely constituted for improvement in a cell performance etc., since gas had become a passage with pile structure, the electrode had the trouble that there was a possibility of outgassing becoming inadequate and causing cell performance degradation on the contrary, when gas occurred inside a cell.

[0004] Even if it was made paying attention to such a conventional trouble and the electrode structure is constituted densely, this invention can fully discharge generating gas outside, and aims at offering the rechargeable battery which can prevent the cell performance degradation depended insufficiently [outgassing].

[0005]

[Means for Solving the Problem] In order to solve the above-mentioned technical problem, invention according to claim 1 On both sides of the separator of gas permeability, wind up in between the positive-electrode side charge collector foil which prepared the positive active material, and the negative-electrode side charge collector foil which prepared the negative-electrode active material to an axis in the air, and the electrode structure is constituted. Two or more charge collector foil side stomata are drilled in the aforementioned positive-electrode side charge collector foil and a negative-electrode side charge collector foil, respectively, two or more axis side stomata are drilled in the aforementioned axis, and the gas passageway which discharges the gas which occurred in the aforementioned electrode structure in the aforementioned charge collector foil side stoma and the aforementioned axis side stoma is formed, and let a bird clapper be a summary. When gas occurs within the electrode structure in charge and discharge by this composition, even if the electrode structure is densely constituted by winding up of the layered product of a positive-electrode side charge collector foil, separator, and a negative-electrode side charge collector foil, generating gas is discharged outside through a gas passageway.

[0006] In the rechargeable battery of the claim 1 above-mentioned publication, invention according to claim 2 makes the minerals particle which has insulation all over the aforementioned negative-electrode side charge collector foil containing the whole surface and the aforementioned negative-electrode active material containing the aforementioned positive active material of the aforementioned positive-electrode side charge collector foil, respectively support, and makes a bird clapper a summary. Even when breakage arises in separator in the time of gas eecrisis etc. by this composition, it is prevented that a positive-electrode side charge collector foil and a negative-electrode side charge collector foil contact electrically, and unusual generation of heat does not arise.

[0007] In the rechargeable battery of the claim 1 above-mentioned publication, invention according to claim 3 forms the slot-like gas passageway which the aforementioned charge collector foil side stoma faces the inside of the cell case which contains the aforementioned electrode structure, and makes a bird clapper a summary. By this composition, eecrisis of generating gas becomes fitness further because a gas passageway increases.

[0008] Invention according to claim 4 forms the gas passageway which discharges the gas which occurred in the electrode structure concerned in the electrode structure constituted including the positive-electrode side charge collector foil wound up on the axis, and the negative-electrode side charge collector foil, and makes a bird clapper a summary. Even if the electrode structure is densely constituted by this composition, a gas passageway can be realized by two or more stomata drilled in each of for example, a positive-electrode side charge collector foil and a negative-electrode side charge collector foil, two or more stomata drilled in the axis, the centrum of an axis, etc., and an operation of invention of the claim 1 above-mentioned publication and the same operation as abbreviation are obtained by it.

[0009]

[Effect of the Invention] According to invention according to claim 1, on both sides of the separator of gas permeability, wind up in between the positive-electrode side charge collector foil which prepared the positive active material, and the negative-electrode side charge collector foil which prepared the negative-electrode active material to an axis in the air, and the electrode structure is constituted. Two or more charge collector foil side stomata are drilled in the aforementioned positive-electrode side charge collector foil and a negative-electrode side charge collector foil, respectively. Since the gas passageway which discharges the gas which drilled two or more axis side stomata in the aforementioned axis, and occurred in the aforementioned electrode structure in the aforementioned charge collector foil side stoma and the aforementioned axis side stoma was formed, Even if the electrode structure is constituted densely, the cell performance degradation depended insufficiently [outgassing] can be prevented by generating gas being discharged outside through a gas passageway.

[0010] Since the minerals particle which has insulation all over the aforementioned negative-electrode side charge collector foil containing the whole surface and the aforementioned negative-electrode active material containing the aforementioned positive active material of the aforementioned positive-electrode side charge collector foil, respectively was made to support according to invention according to claim 2, even when breakage arises in separator at the time of gas discharge etc., unusual generation of heat by electric contact in a positive-

electrode side charge collector foil and a negative-electrode side charge collector foil is suppressed, and cell degradation can be prevented. [0011] According to invention according to claim 3, the cell performance degradation which discharge of generating gas becomes much more good, and depends on it insufficiently [outgassing] since the slot-like gas passageway which the aforementioned charge collector foil side stoma faces was formed in the inside of the cell case which contains the aforementioned electrode structure can be prevented much more certainly.

[0012] Since the gas passageway which discharges the gas which occurred in the electrode structure concerned was formed in the electrode structure constituted including the positive-electrode side charge collector foil wound up on the axis, and the negative-electrode side charge collector foil according to invention according to claim 4, Even if the electrode structure is constituted densely, it can realize by two or more stomata drilled in each of for example, a positive-electrode side charge collector foil and a negative-electrode side charge collector foil, two or more stomata drilled in the axis, the centrum of an axis, etc., and a gas passageway has the effect of the invention of the claim 1 above-mentioned publication, and the same effect as abbreviation.

[0013]

[Embodiments of the Invention] Hereafter, the form of operation of this invention is explained based on a drawing.

[0014] Drawing 1 or drawing 5 is drawing showing the form of operation of the 1st of this invention. First, the composition of a rechargeable battery is explained using drawing 1 or drawing 4. Drawing 1 shows whole composition. Drawing of longitudinal section and this drawing (c) of this drawing (a) showing [an appearance perspective diagram and / this] an internal configuration (b) are a cross-section perspective diagram. In these drawings, 1 is a cell case, terminals 2 and 3 are formed in the ends, and the cleavage valve 4 for emitting the gas which occurred inside the cell is formed in the center section of each terminals 2 and 3. In the cell case 1, the separator 12 with which the charge collector foil with which the positive active material was applied, and the charge collector foil with which the negative-electrode active material was applied contain the electrolytic solution is inserted in between, and the electrode structure 10 which was able to be wound up to the spiral on the winding heart (axis) 13 in the air is contained so that it may mention later. The positive electrode of the electrode structure 10 is connected to an anode terminal, and the negative electrode is connected to the cathode terminal. and the direction which intersects perpendicularly with the charge collector foil which constitutes the electrode structure 10 with the longitudinal direction of the electrode structure 10 -- a gas evolution -- two or more stomata 11 used as a hole open -- having -- the winding heart 13 in the air -- the same -- a gas evolution -- two or more stomata 14 used as a hole have opened

[0015] Drawing 2 shows the composition (this drawing (a)) of the charge collector foil 7, and the composition (this drawing (b)) of the winding heart 13. The application field of an active material 8 and the drilling field of a stoma 11 divide a position in the winding-up direction and this direction, and two or more trains formation is carried out by turns at the charge collector foil 7. Moreover, in each position corresponding to the drilling field of the stoma 11 by the side of the charge collector foil 7, two or more stomata 14 have opened in the winding heart 13 at the hoop direction, respectively. Each stoma 14 by the side of the winding heart 13 is a little larger than each stoma 11 by the side of the charge collector foil 7.

[0016] Drawing 3 shows the laminated structure of the charge collector foil 7b and the separator 12 used as charge collector foil 7a used as a positive electrode 5, and a negative electrode 6. Drawing 3 (b) is drawing which expands the A-A line cross section of this drawing (a), and is shown typically. The minerals particle 9 which has insulation, such as a silica and Sic, is supported with the binder by each charge collector foils 7a and 7b of a positive electrode 5 and a negative electrode 6 all over including the application field of the positive and negative active materials 8a and 8b. Separator 12 has gas permeability with filter ability, and the electrolytic solution contains it.

[0017] Drawing 4 and drawing 5 show the example of structure of a terminal 2 and the three sections, respectively. In terminal 2a of drawing 4, the screw hole 16 is established in the contact surface with a pressure connection terminal 15, and the pressure connection terminal 15 is attached by the screw stop. A screw thread 18 is cut with terminal 2b of drawing 5 by the axis section, and the pressure connection terminal 15 is attached by the fasten lump of a nut 19 by it. And the contact surface with a pressure connection terminal 15 has the ends children 2a and 2b for extensive area.

[0018] Next, an operation of the rechargeable battery constituted as mentioned above is explained using drawing 6. A gas passageway is formed by the centrum of each stoma 14 which was able to be opened in each stoma 11 which was able to be opened in the charge collector foil 7, the separator 12 of gas permeability, and the winding heart 13, and the winding heart 13. When gas occurs in the electrode structure 10 interior in the charge and discharge of a rechargeable battery, generating gas passes along the above-mentioned gas passageway, and is emitted outside from a terminal 2 and the cleavage valve 4 of three center sections. Therefore, phenomena, such as cell performance degradation, are prevented more insufficiently [outgassing]. And even if separator 12 may be torn in the time of a gas evolution etc., by the minerals particle 9 which has insulation all over the charge collector foils 7a and 7b being supported, charge collector foil 7a of positive and negative electrodes 5 and 6 and 7b do not contact directly, and unusual generation of heat does not occur.

[0019] The form of operation of the 2nd of this invention is shown in drawing 7. The form of this operation prepares the slot-like gas passageway which the stoma 11 by the side of the charge collector foil 7 faces the internal surface of a cell case. This drawing (a) forms a gas passageway 21 in the internal surface of cell case 1a along with two or more stomata 11 of the charge collector foil 7. It secures outgassing, this drawing (b) establishing the fine slot 22 used as a gas passageway in the internal surface of cell case 1b, and holding the electrode structure 10 by all the insides of cell case 1b. The cross-section configuration of a slot 22 is good in a proper configuration. This drawing (c) forms a gas passageway 21 in the internal surface of cell case 1c, and forms the fin 23 for heat dissipation in an outside surface. Even if it applies which cell cases 1a, 1b, and 1c, outgassing from a cell becomes much more good because the gas passageway of the whole cell increases.

[Translation done.]